Short Description of MAC 802.15.4

IEEE 802.15.4 is a low data-rate wireless personal area network(WPAN) and is the PHY and MAC(Medium Access Control) layer used by many IoT protocols. The MAC enables the transmission of MAC frames through the use of a physical channel. Besides the data service, it offers a management interface and itself manages access to the physical channel and network beaconing. It also controls frame validation,guarantees time slots and handles node associations.However, by using MAC 802.15.4 packet drop ratio is increasing.

Short Description of AODV Routing Protocol

AODV(Ad-hoc On-demand Distance Vector) is a loop-free routing protocol for ad-hoc networks. It is designed to be self starting in an environment of mobile nodes withstanding a variety of network behaviours such as packet losses,link failures and node mobility. At each node, AODV maintains a routing table. The routing table entry for a destination contains three essential fields: a next hop node, a sequence number and a hop count. All packets destined to the destination are sent to the next hop node. The sequence number acts as a form of time-stamping, and is a measure of the freshness of a route. The hop count represents the current distance to the destination node. Update of any node will be happened, if the sequence number of that node is higher or in the case of equality of sequence number, if hop count is smaller. On receipt of the three AODV messages: RREQ, RREP and RERR, the nodes update the next hop, sequence number and the hop counts of their routes in such a way as to satisfy this constraint. In AODV, nodes discover routes in request-response cycles. A node requests a route to a destination by broadcasting an *RREQ* message to all its neighbors. Destination node responds with an *RREP* message which is unicast. Thus, at the end of this request-response cycle a bidirectional route is established between the requesting node and the destination.

## Short Description of UDP Agent

A UDP agent accepts data in variable size chunks from an application, and segments the data if needed. In UDP(User Datagram Protocol), there is no acknowledgement from receiver to sender. So, UDP is unreliable. Null agent is used on the receiver side to ensure that receiver could just receive packets and could not send any ACK packet in reply. In UDP, there is no guarantee of packet delivery, ordering, or duplicate protection because there are no error-correction facilities in this protocol. UDP is suitable for purposes where either error-checking and error-correction are not necessary or are performed in the Application layer. UDP avoids such overhead of this processing in the protocol stack.

## Short Description of Exponential Traffic Application

Traffic generator objects generate traffic and can be of four types named exponential, pareto, CBR and traffic trace. Exponential on/off traffic generator can be created and parameterized with packet_size,burst_time,idle_time and rate. Exponential traffic objects generate On/Off traffic. During "on" periods, packets are generated at a constant burst rate. During "off" periods, no traffic is generated. Burst times and idle times are taken from exponential distributions. Here, packet_size means constant size of packets generated; burst_time means average on time for generator; idle_time means average off time for generator and rate means sending rate of packets during "on" period of flow/traffic generator.

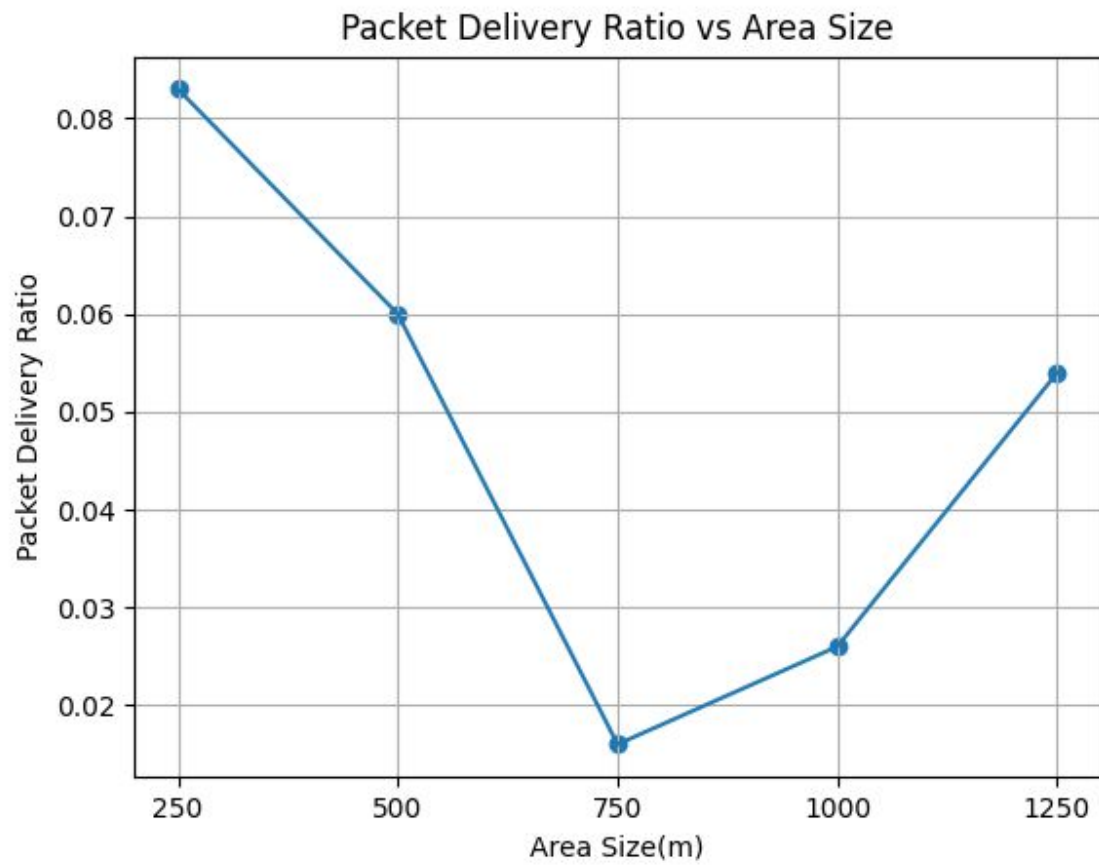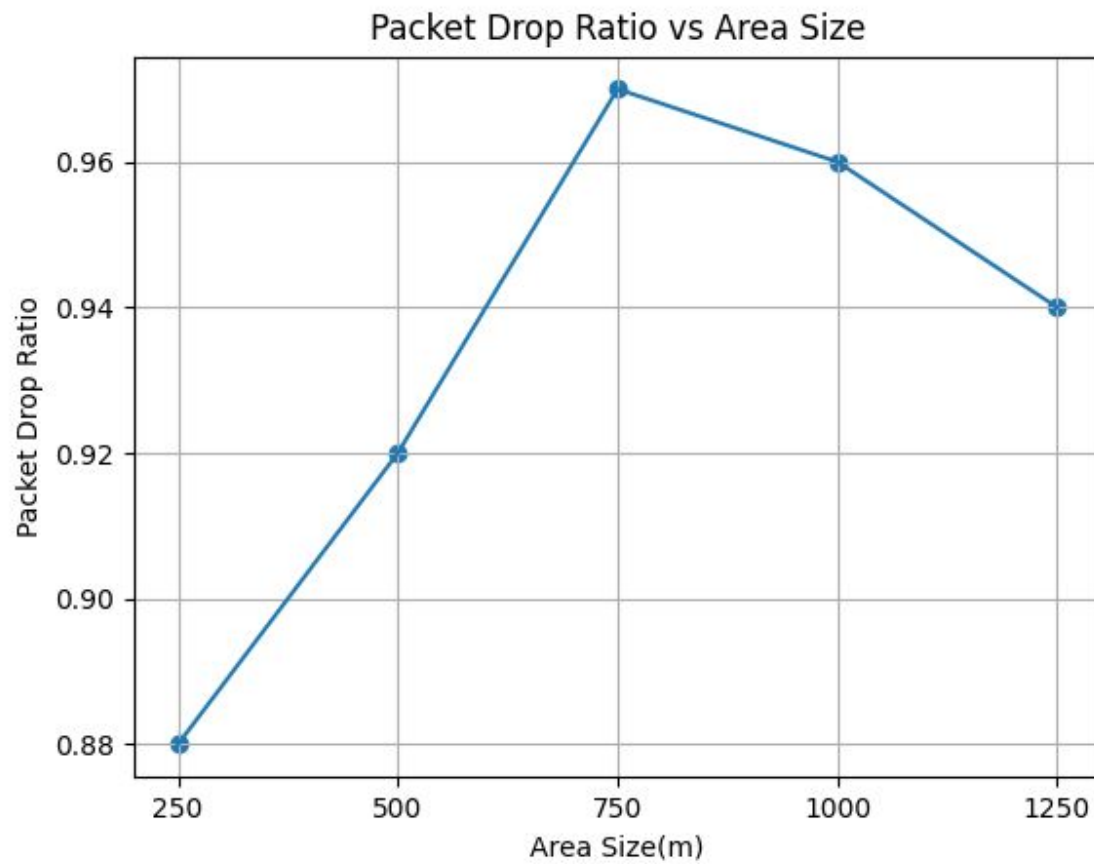## 1. **Network Throughput vs Area Size**
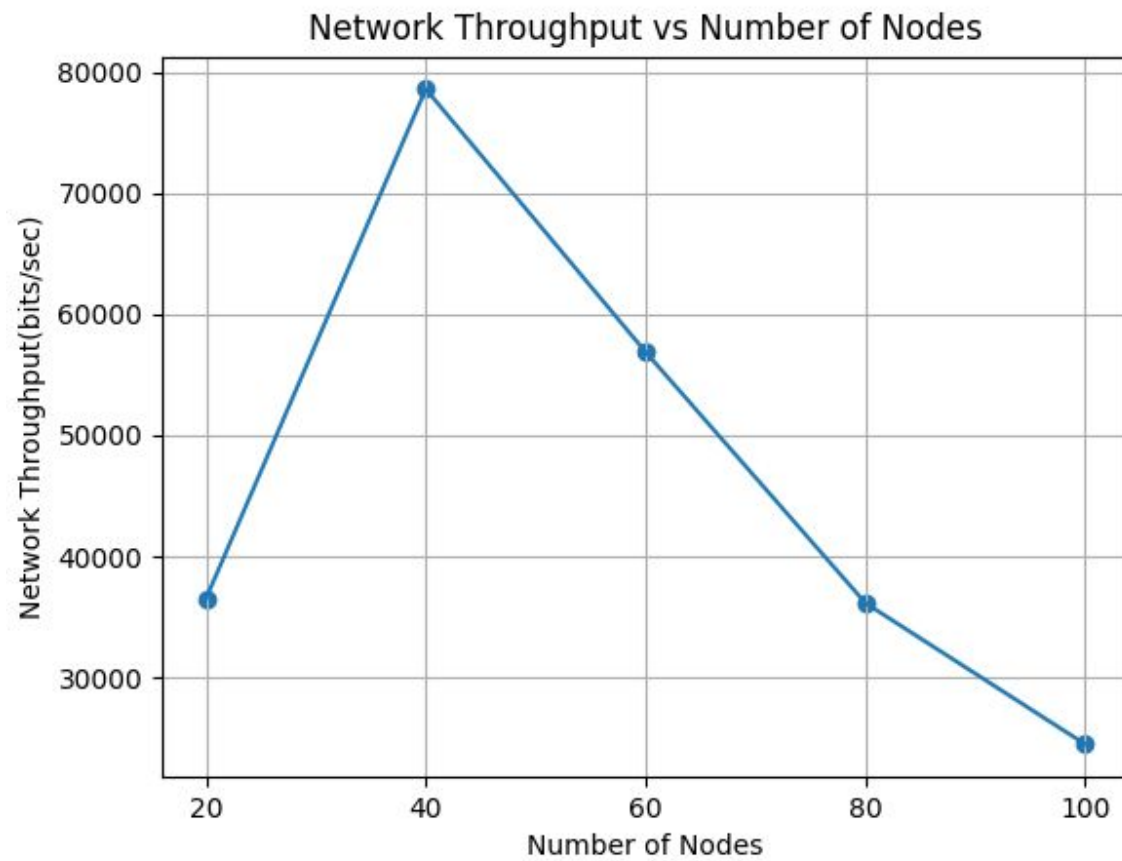
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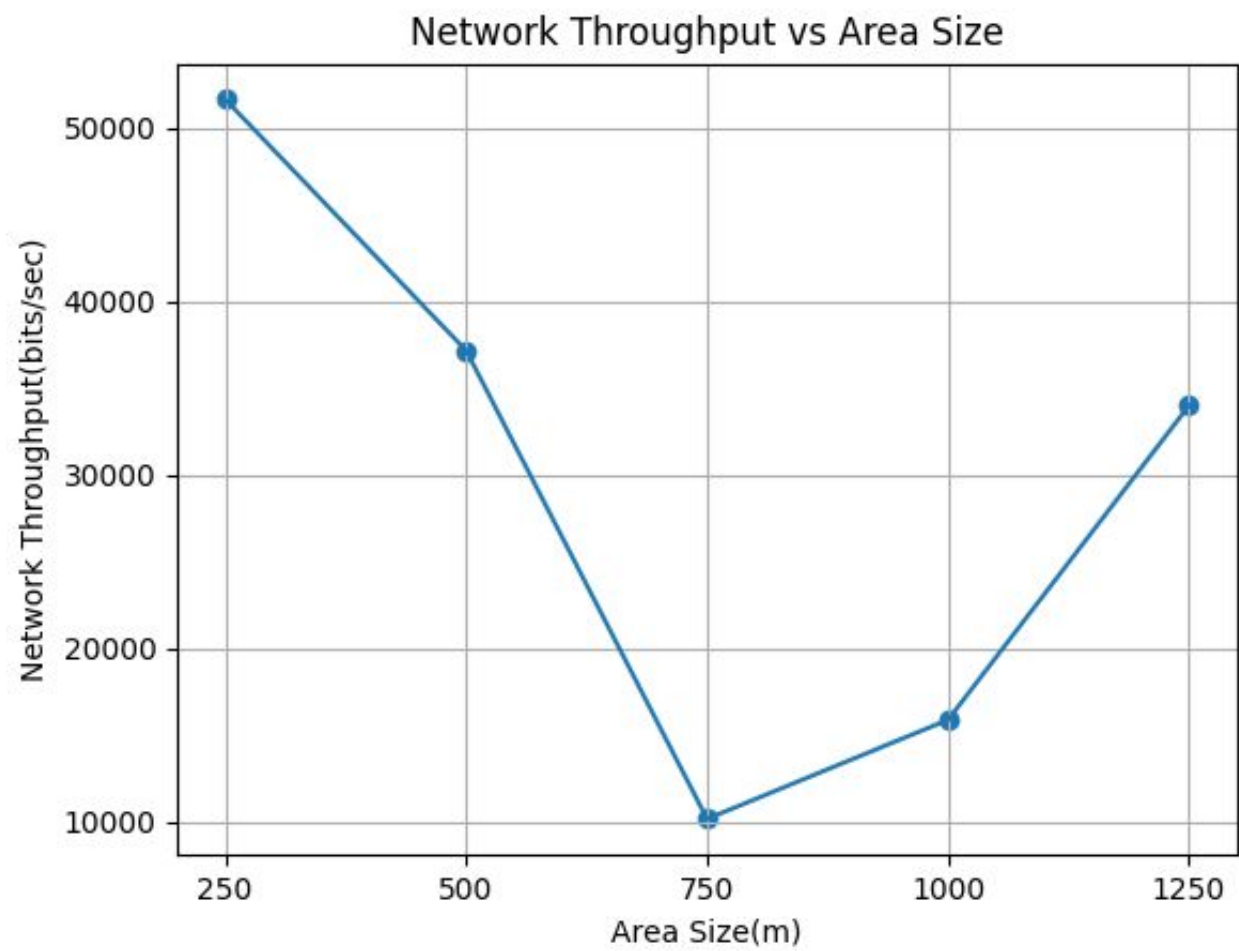
End-to-end Average Delay vs Area Size

3. Packet Delivery Ratio vs Area Size
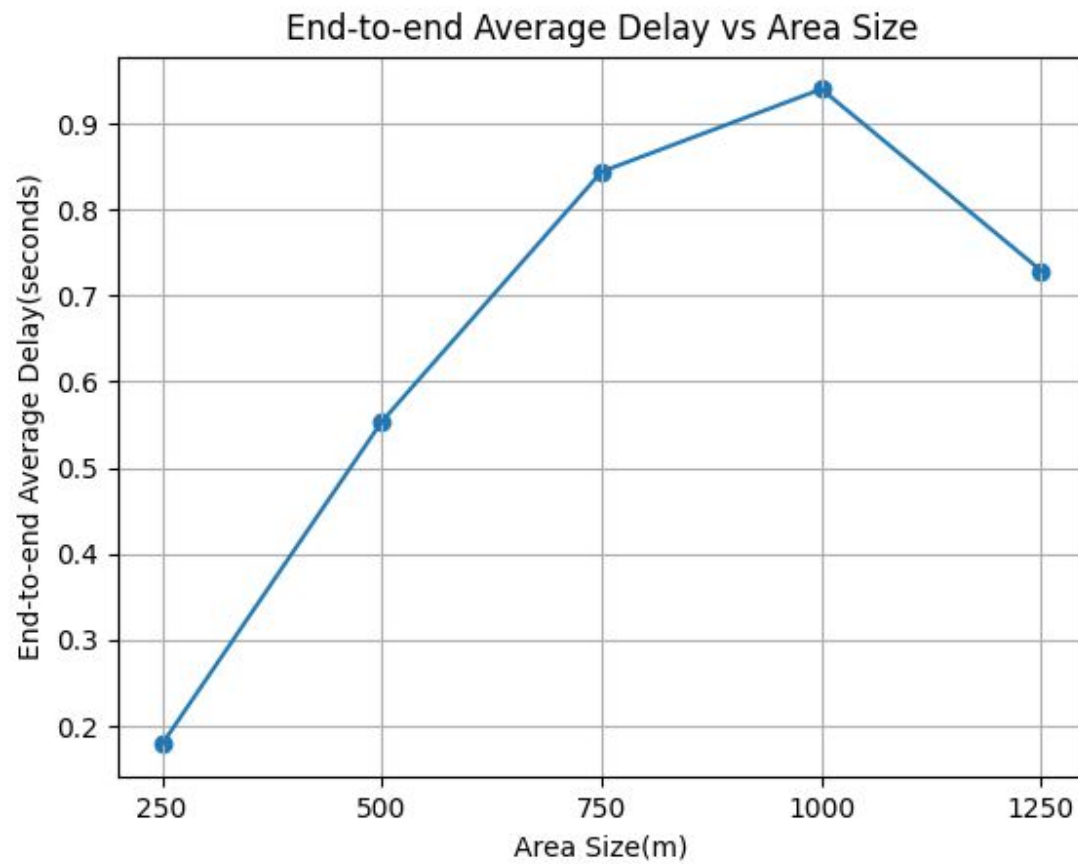
Packet Delivery Ratio vs Area Size

4.Packet Drop Ratio vs Area Size
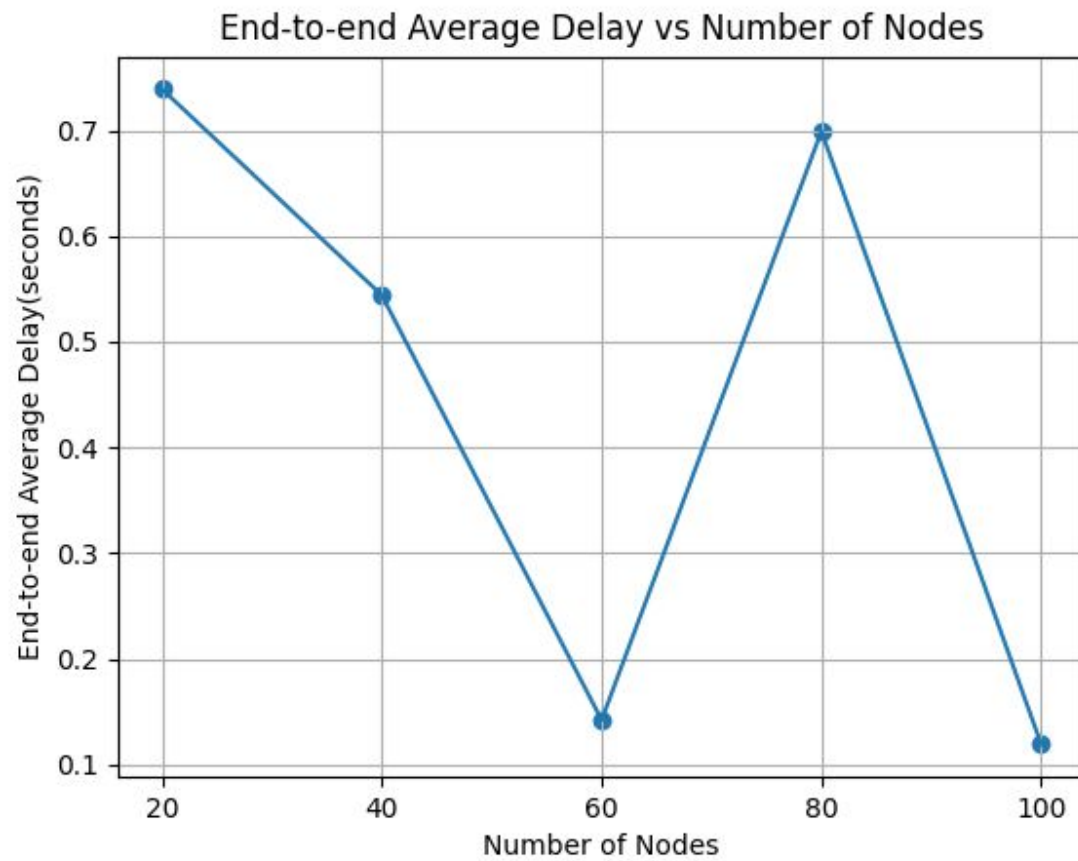

Packet Drop Ratio vs Area Size

5.Network Throughput vs Number of Nodes
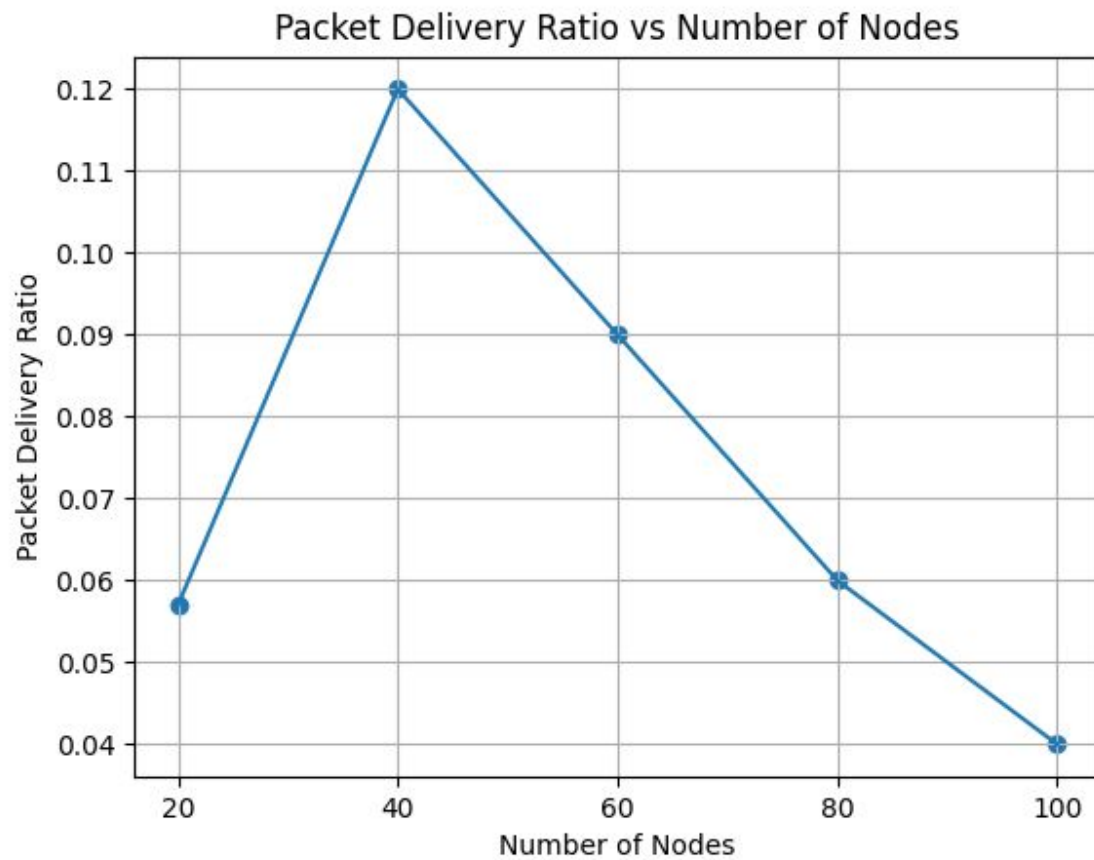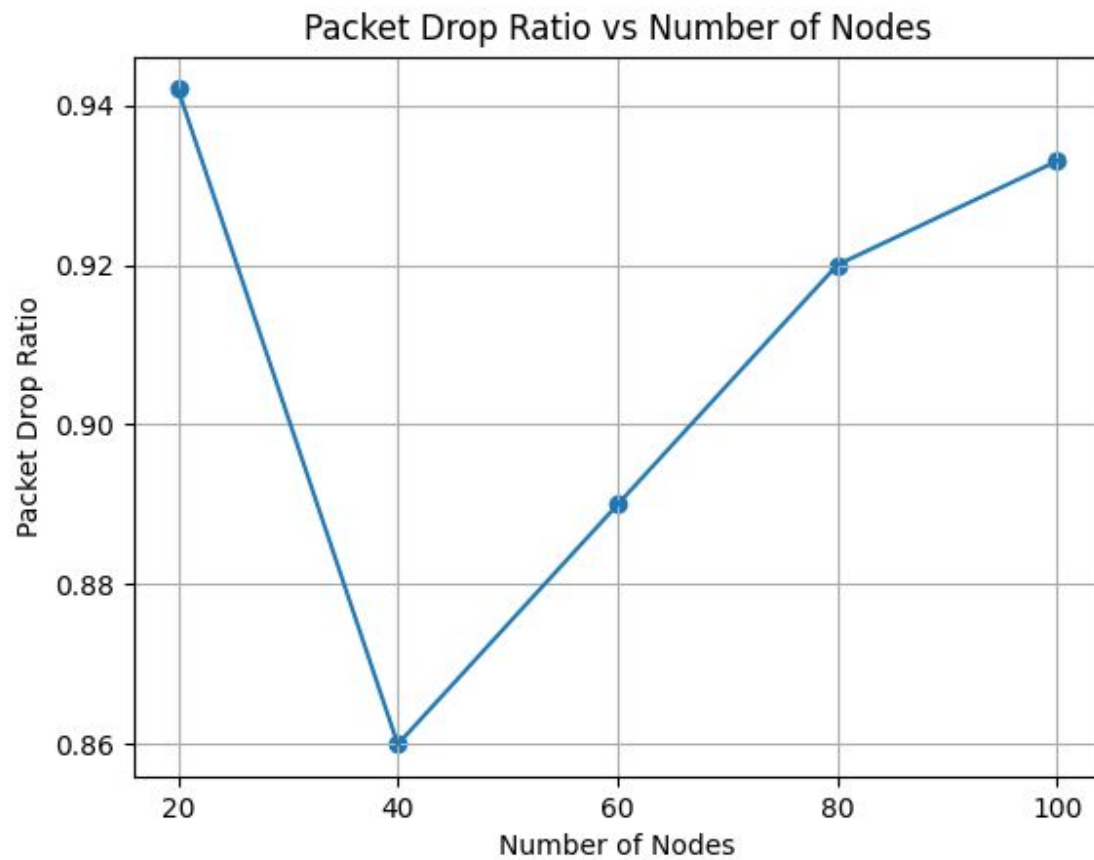
6. End-to-end Average Delay vs Number of Nodes

End-to-end Average Delay vs Number of Nodes

7.Packet Delivery Ratio vs Number of Nodes
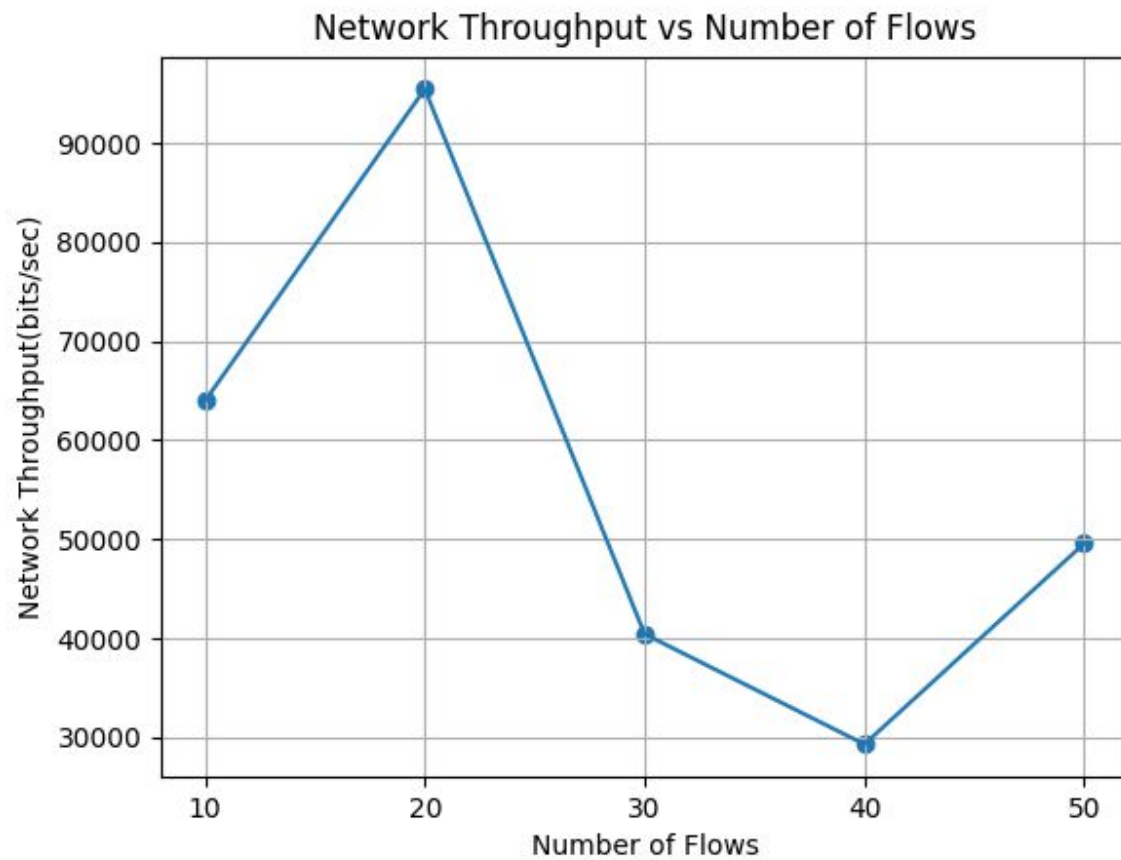

Packet Delivery Ratio vs Number of Nodes

8.Packet Drop Ratio vs Number of Nodes
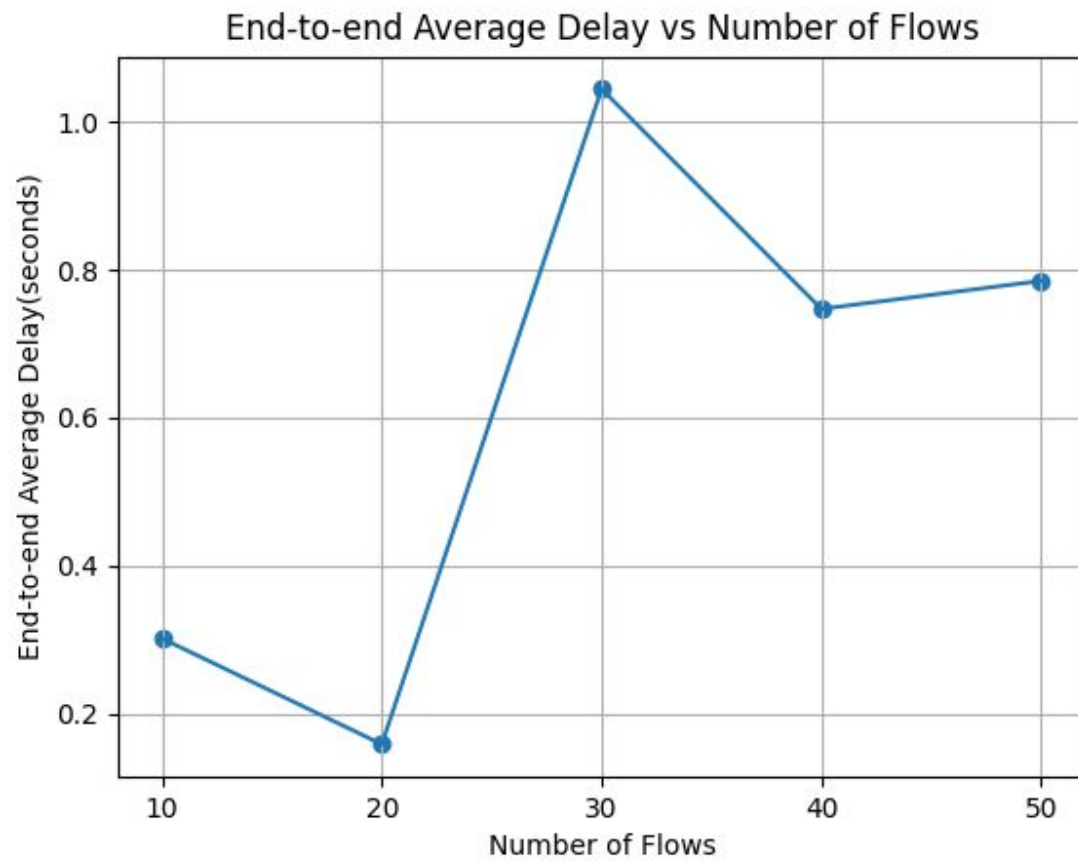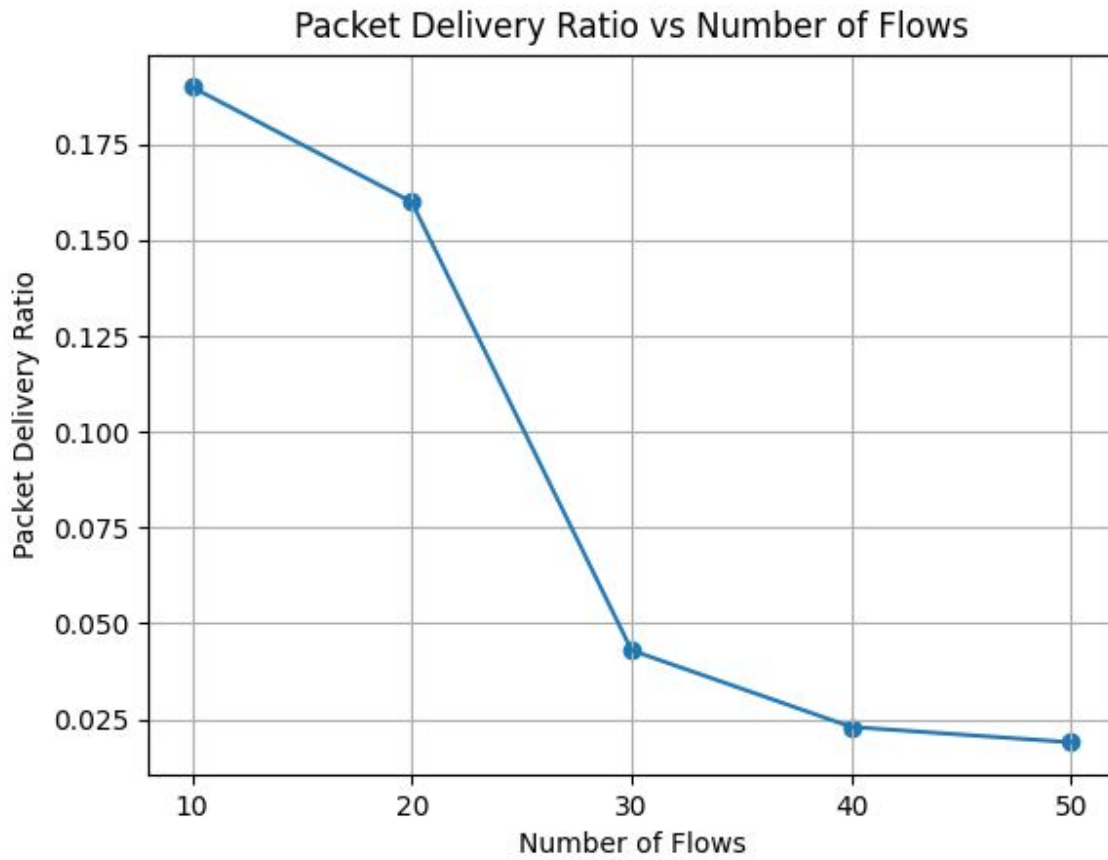

Packet Drop Ratio vs Number of Nodes

9.Network Throughput vs Number of Flows

10. **End-to-end Average Delay vs Number of Flows**
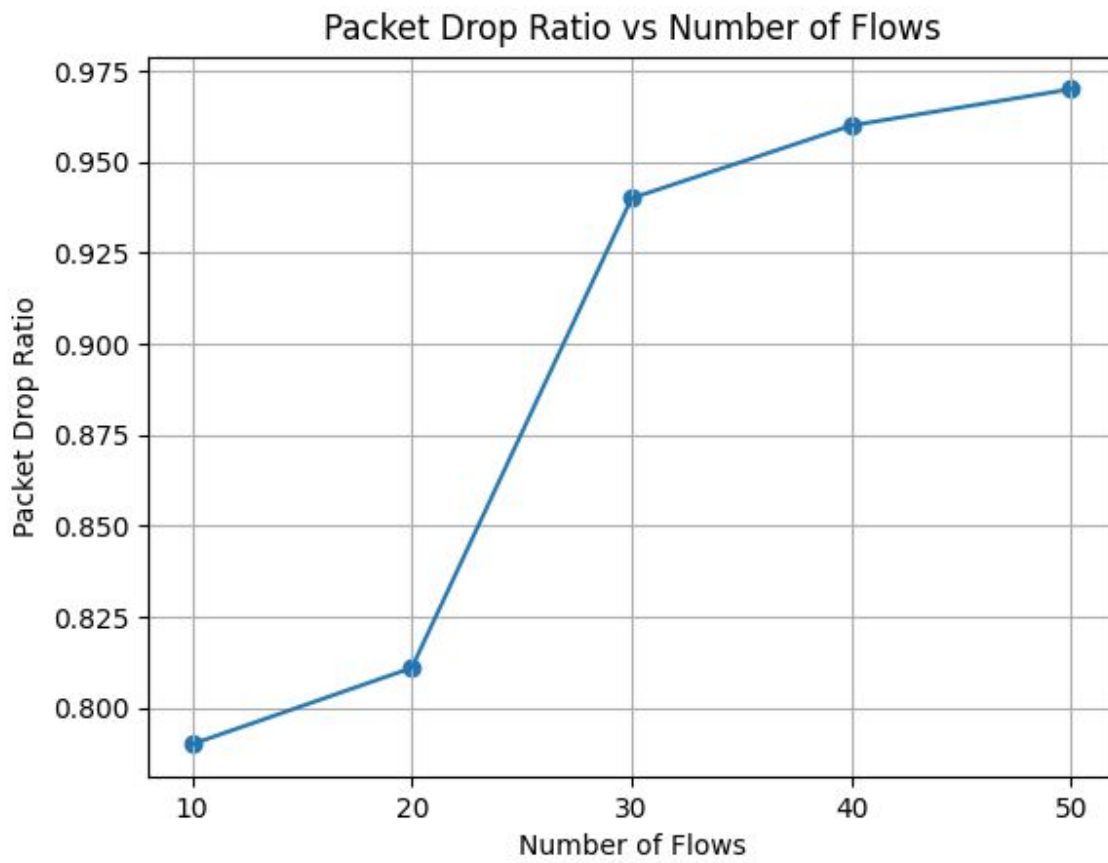

End-to-end Average Delay vs Number of Flows

11. **Packet Delivery Ratio vs Number of Flows**

12. Packet Drop Ratio vs Number of Flows

Short Observation of the results

We have shown that because of using UDP and Exponential Traffic generator in MAC type 802.15.4, packet drop ratio is very much larger. Around 90 percent packets are dropped on average in our simulation. Another thing to be noted is that the more number of flows, the less delivery ratio is found which means among all of the sent packets, the destination node receives very less packets. If number of flows is half of number of nodes, delivery ratio slightly increases in 250*250 area. That means, by increasing area size and number of nodes also, delivery ratio is becoming smaller. However, since we use random sources and destinations, the results are not exactly the same for all simulations. In a nutshell, we can conclude that the combination of UDP protocol and Exponential Traffic Generator is not that much useful due to higher drop rate.